

## CLAIMS

1. A handover method between two radio systems with different physical traffic channels and different radio link protocols comprising  
5 retransmission mechanisms, the method comprising a step of

handing over a non-transparent call from a traffic channel of the old radio system to a traffic channel of the new radio system,

**characterized** in that the method comprises further steps of retaining the radio link protocol of the old radio system between a

10 mobile station and an interworking function,

transmitting the radio link protocol frames of the old radio system adapted to the traffic channel of the new radio system.

2. A method according to claim 1, **characterized** in that the length of the radio link protocol frames of the old radio system equals the  
15 length of the radio link protocol frames of the new radio system, and that said adaptation step comprises a step of

inserting the radio link protocol frames of the old radio system as such into protocol data units of a lower protocol layer on the traffic channel of the new radio system in place of the radio link protocol frames of the new radio  
20 link protocol.

3. A method according to claim 1, **characterized** in that the radio link protocol frames of the old radio system are longer than the radio link protocol frames of the new radio system, and that said adaptation step comprises steps of

25 splitting the radio link protocol frames of the old radio system into data blocks,

inserting said data blocks into the protocol data units of the lower protocol layer on the traffic channel of the new radio system in place of the radio link protocol frames of the new radio link protocol.

30 4. A method according to claim 3, **characterized** by inserting filler into one or several data blocks if the length of the radio link protocol frame in the old radio system is different from a multiple of the length of the radio link protocol frame in the new radio system.

35 5. A method according to claim 1, **characterized** in that the radio link protocol frames of the old radio system are shorter than the radio link

protocol frames of the new radio system, and that said adaptation step comprises steps of

concatenating the radio link protocol frames of the old radio system,

forming from the concatenated radio link protocol frames data

5 blocks the length of which equals the length of the radio link protocol frames of the new radio system,

inserting said data blocks into the protocol data units of the lower protocol layer on the traffic channel of the new radio system in place of the radio link protocol frames of the new radio link protocol.

10 6. A method according to claim 5, **characterized** by

inserting filler into one or several data blocks if the length of the radio link protocol frame in the new radio system is different from a multiple of the length of the radio link protocol frame in the old radio system.

a 7. A method <sup>According To CLAIMS</sup> ~~according to claim 6 or 6~~, **characterized** by

inserting into each data block one or more complete radio link protocol frames and a part of a radio link protocol frame in a concatenated form, if the length of the radio link protocol frame in the new radio system is different from a multiple of the length of the radio link protocol frame in the old radio system.

20 8. A method according to claim 1, **characterized** in that said adaptation step comprises steps of

setting up the radio link protocol of the new radio system between the mobile station and the interworking function,

transmitting the radio link protocol frames of the old radio system

25 transparently within the radio link protocol of the new radio system without using the retransmission mechanism of the latter.

9. A method according to claim 8, **characterized** in that said transmission step comprises steps of

inserting the radio link protocol frames of the old radio system into

30 the payload field of the radio link protocol frames of the new radio system at the transmitting end,

transmitting the radio link protocol frames of the new radio system from the transmitting end to the receiving end without using the retransmission mechanism,

35 synchronizing the receiving end with the radio link protocol frames of the new radio system,

extracting the radio link protocol frames of the old radio system from the payload field of the radio link protocol frames of the new radio system,

operating with the extracted radio link protocol frames according to the radio link protocol and retransmission mechanism of the old radio system.

5 10. A method according to claim 8, characterized by performing a handover from the traffic channel of the new radio system back to the traffic channel of the old radio system,

retaining the radio link protocol of the old radio system in the mobile station and in the interworking function

10 11. A method ~~according to any one of the preceding claims~~, characterized in that the new and the old radio system are separate mobile communication systems or different radio access networks of the same mobile system.

12. A dual-mode mobile station (MS) with capacity to operate between two radio systems with different physical traffic channels and different radio link protocols (LAC, RLP) comprising retransmission mechanisms, the mobile station (MS) comprising

adapter means (TAF) for establishing a first radio link protocol in a non-transparent call between the mobile station and an interworking function

20 in a first radio system, and a second radio link protocol between the mobile station and the interworking function in a second radio system,

means for performing a handover for the non-transparent call from a traffic channel of the first radio system to a traffic channel of the second radio system and vice versa,

25 characterized in that  
said adapter means (TAF) are arranged to retain the radio link protocol of the old radio system between the mobile station and the interworking function in a handover that is carried out from the traffic channel of the first radio system to the traffic channel of the second radio system, or  
30 vice versa,

said adapter means (TAF) are arranged to transmit the radio link protocol frames of the old radio system adapted to the traffic channel of the new radio system.

13. A mobile station according to claim 12, characterized in  
35 that said adapter means (TAF) are arranged to insert the radio link protocol frames (LAC) of the old radio system into protocol data units of a lower

protocol layer on the traffic channel of the new radio system in place of the radio link protocol frames of the new radio link protocol (RLP) either as such, or split into data blocks or concatenated into data blocks, depending on whether the length of the radio link protocol frames of the radio system is 5 equal to, longer than or correspondingly shorter than the length of the radio link protocol frames of the new radio system.

14. A mobile station according to claim 12, characterized in that said adapter means (TAF) are also arranged to set up the radio link protocol of the new radio system between the mobile station and the 10 interworking function, and to transmit the radio link protocol frames (LAC) of the old radio system transparently within the radio link protocol (RLP) of the new radio system without using the retransmission mechanism of the latter.

15. A mobile station according to claim 14, characterized in that said adapter means (TAF) are arranged to transmit the radio link protocol frames (LAC) of the old radio system transparently in the payload field of the radio link protocol frames (RLP) of the new radio system.

a 16. A mobile station, ~~according to any one of claims 12 to 15,~~ <sup>according TO CLAIM 12</sup> characterized in that said adapter means are arranged to retain the radio link protocol (LAC) of the old radio system in the mobile station and in the interworking function if a handover is later carried out from the traffic channel of the new radio system back to the traffic channel of the old radio system.

17. A telecommunication system comprising an arrangement for performing a handover between two radio systems with different physical 25 traffic channels and different radio link protocols (LAC, RLP), characterized in that a mobile station (MS) and an interworking function (IWF) are arranged to retain the radio link protocol of the old radio system when a handover for a non-transparent call is carried out from a traffic channel of the old radio system to a traffic channel of the new radio system, and to transmit 30 the radio link protocol frames of the old radio system adapted to the traffic channel of the new radio system.

18. A telecommunication system according to claim 17, characterized in that the mobile station (MS) and the interworking function (IWF) are arranged to insert the radio link protocol frames of the old radio system 35 into protocol data units of a lower protocol layer on the traffic channel of the new radio system in place of the radio link protocol frames of the new radio

link protocol either as such, or split into data blocks or concatenated into data blocks, depending on whether the length of the radio link protocol frames of the radio system is equal to, longer than or correspondingly shorter than the length of the radio link protocol frames of the new radio system.

5        19. A telecommunication system according to claim 17, characterized in that the mobile station (MS) and the interworking function (IWF) are also arranged to set up the radio link protocol of the new radio system between the mobile station and the interworking function, and to transmit the radio link protocol frames of the old radio system transparently within the radio  
10 link protocol of the new radio system without using the retransmission mechanism of the latter.

15        20. A telecommunication system according to claim 19, characterized in that said adapter means are arranged to transmit the radio link protocol frames of the old radio system transparently in the payload field of the radio link protocol frames of the new radio system.

20        21. A telecommunication system, ~~according to any one of claims 17 to 24~~, characterized in that the old and the new radio system are separate mobile communication system or different radio access networks of the same mobile system.

25        22. A handover method in a telecommunication system where a mobile station is able to use as an access network a wired access network or a radio access network with different link protocols for non-transparent calls, the method comprising a step of

handing over a non-transparent call from a wired access network to  
25 a radio access network, or vice versa,

characterized in that the method comprises further steps of retaining the link protocol of the old access network between the mobile station and the interworking function,

transmitting the link protocol frames of the old access network  
30 adapted to the transmission path of the new access network.

35        23. A telecommunication system where a mobile station is able to use as an access network a wired access network or a radio access network with different link protocols for non-transparent calls, the system comprising an arrangement for performing a handover between the wired access network and the radio access network or between two wired access networks, characterized in that the mobile station and an interworking function

are arranged to retain the link protocol of the old access network when a handover for a non-transparent call is carried out from the wired access network to the radio access network or vice versa, and to transmit the link protocol frames of the old access network adapted to the transmission path of  
5 the new access network.

24. A dual-mode mobile station with ability to use a wired access network as the access network, or comprising different link protocols for non-transparent calls, the mobile station comprising

10 adapter means for forming a first link protocol in a non-transparent call between the mobile station and an interworking function in a radio access network, and a second link protocol between the mobile station and an interworking function in a wired access network,

15 means for performing a handover for a non-transparent call from the wired access network to the radio access network and vice versa, or over a wired connection from the access network,

**c h a r a c t e r i z e d** in that

said adapter means are arranged to retain the link protocol of the old access network between the mobile station and the interworking function in a handover carried out from one wired access network to another,

20 said adapter means are arranged to transmit the link protocol frames of the old access network adapted to the transmission path of the new access network.

25. A handover method in a telecommunication system where a terminal equipment is able to use as an access network two wired access networks with different link protocols for non-transparent calls, the method comprising

handing over a non-transparent call from one wired access network to another,

30 **c h a r a c t e r i z e d** in that the method comprises further steps of retaining the link protocol of the old access network between the terminal equipment and the interworking function,

transmitting the link protocol frames of the old access network adapted to the transmission path of the new access network.

35 26. A telecommunication system where a terminal equipment is able to use as an access network two wired access networks with different link protocols for non-transparent calls, the system comprising an arrangement for

performing a handover between said two wired access networks, **characterized** in that the terminal equipment and the interworking function are arranged to retain the link protocol of the old access network when a handover for a non-transparent call is carried out from one wired access network to another, and to transmit the link protocol frames of the old access network adapted to the transmission path of the new access network.

27. A dual-mode terminal equipment with ability to use as an access network two wired access networks with different link protocols for non-transparent calls, the mobile station comprising

10        adapter means for forming a first link protocol in a non-transparent call between the terminal equipment and an interworking function in the first wired access network, and a second link protocol between the terminal equipment and an interworking function in the second wired access network,  
            means for performing a handover for a non-transparent call from  
15     one wired access network to another,  
            **characterized** in that  
            said adapter means are arranged to retain the link protocol of the old access network between the terminal equipment and the interworking function in a handover carried out from one wired access network to another,  
20     said adapter means are arranged to transmit the link protocol frames of the old access network adapted to the transmission path of the new access network.

28. A data transmission method in a mobile communication system comprising a mobile services switching centre with a first link protocol provided with a retransmission mechanism for non-transparent data transmission; a radio access network with a second link protocol provided with a retransmission mechanism for non-transparent data transmission; and an interworking unit via which the radio access network is connected to the mobile services switching centre, the method comprising steps of  
30     transmitting data in the frames of the first link protocol between the interworking unit and the mobile services switching centre,  
            using frame numbering in said retransmission mechanism between the interworking unit and the mobile services switching centre,  
            **characterized** by  
35     adapting the first link protocol in the interworking unit to the radio access network so that the retransmission of data is controlled from end to

end between the mobile services switching centre and the mobile station by means of said frame numbering.

29. A method according to claim 28, characterized by negotiating, during the set-up of the connection between the mobile station 5 and the mobile services switching centre, the manner in which the first link protocol is adapted to the radio access network.

30. A method according to claim 29, characterized in that said negotiation comprises steps of

using signalling according to the first link protocol between the 10 interworking unit and the mobile services switching centre,

using signalling according to the second link protocol between the interworking unit and the mobile station,

performing a conversion between the two types of signalling in the interworking unit.

15 a 31. A method <sup>according To claim 28</sup> ~~according to claim 28, 29 or 30~~, characterized by

using the first link protocol between the interworking unit and the mobile services switching centre,

using the second link protocol between the interworking unit and the 20 mobile station,

selecting the frame length and frame numbering of the first and the second link protocol identically,

performing a conversion between the link protocols in the interworking unit.

25 a 32. A method <sup>according To claim 28</sup> ~~according to claim 28, 29 or 30~~, characterized by

setting up the first link protocol from end to end between the mobile station and the mobile services switching centre,

transmitting the frames of the first link protocol between the mobile 30 services switching centre and the mobile station adapted to the traffic channel of the new radio system, such that said first link protocol is applied from end to end between the mobile station and the mobile services switching centre.

33. A method according to claim 32, characterized by selecting said first link protocol in the mobile station as a protocol 35 version of said second link protocol by using signalling according to the second link protocol.

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~~According To Claim 32~~

a 34. A method ~~according to claim 32 or 33~~, characterized in that said adaptation to the traffic channel comprises a step of

inserting, in the mobile station or in the interworking unit, the frames of the first link protocol as such into protocol data units of a lower protocol layer on the traffic channel of the radio access system in place of the frames of the second link protocol.

a 35. A method ~~according to claim 32 or 33~~, characterized in that said adaptation step comprises steps of

setting up said second link protocol between the mobile station and 10 the interworking unit,

transmitting the frames of the first link protocol within the second link protocol.

36. A method according to claim 35, characterized in that said transmission step comprises steps of

15 inserting the frames of the first link protocol into the payload field of the frames of the second link protocol at the transmitting end,

transmitting the frames of the second link protocol from the transmitting end to the receiving end,

20 synchronizing the receiving end with the frames of the second link protocol,

extracting the frames of the first link protocol from the payload field of the frames of the second link protocol,

operating with the extracted radio link protocol frames according to the radio link protocol and retransmission mechanism of the old radio system.

25 37. A mobile communication system comprising a mobile services switching centre with a first link protocol provided with a retransmission mechanism for non-transparent data transmission and employing frame numbering; a radio access network with a second link protocol provided with a retransmission mechanism for non-transparent data transmission; and an 30 interworking unit via which the radio access network is connected to the mobile services switching centre, characterized in that the interworking unit is arranged to adapt the first link protocol to the radio access network such that the retransmission of data is controlled from end to end between the mobile services switching centre and the mobile station by means 35 of said frame numbering.